

DPW



Feb. 28, 2007

TO: USPTO

Fr: John Paul Maye "Inventor"

Re: Prior Art Information Enclosed for Patent Application No. 09/520,004

Dear Sir or Madam:

Enclosed are 4 pages out of a book titled "Alcohol Distiller's Handbook" copyright 1980. This text was originally published in 1943 by the Educational Division of Joseph E. Seagram, Inc. as a training manual for employees at their spirit plants. On page 57 of this text it mentions that hop extract is commonly added to mash (unfiltered wort) and yeast mash to inhibit the growth of microorganisms.

By 1980, anyone skilled in the art of spirit fermentation is aware that the microorganisms commonly found in distillery mashes are lactic acid producing microorganisms. In addition, anyone skilled in the art of hops is aware that it is the hop acids (alpha acids (humulone) and beta acids (lupulone) and isomerized hop acids (isoalpha acids) that are responsible of the antimicrobial property of hops/hop extract.

Sincerely,

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ALCOHOL DISTILLER'S HANDBOOK

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FOREWORD

From Biblical days to present time, the production of ethyl alcohol has remained cloaked in mystery, controversy and a labyrinth of governmental controls. Before prohibition distillery technology was a carefully guarded science — a proprietary possession that each distiller claimed made their product more desirable than that of competitors.

Prohibition created a supply-demand situation that resulted in the production of alcohol in small, illegal quantities by many ordinary people. While strong in motivation, most were lacking in technical ability, resulting in good quality alcohol being produced more by accident than by design.

After the repeal of prohibition in 1933 the knowledge to produce alcohol was no longer a hidden secret — anyone who desired to could make alcohol of questionable quality. However, with prohibition no longer in effect, the motivation to produce alcohol by other than large industry, was gone. The use of alcohol as a motor fuel and for heating was well known, however, petroleum based fuel was so plentiful and cheap that the use of alcohol would have been a luxury.

For the next fifty years alcohol was destined to serve primarily as a social lubricant and, to a lesser degree, industrial purposes. The production of alcohol quickly became a series of standard practices although largely undocumented by the industry as a whole.

It was with this goal in mind that Herman F. Willkie and Joseph A. Prochaska wrote this book. Originally titled "Fundamentals of Distillery Practice" it was published in 1943 by the Educational Division of Joseph E. Seagram, Inc. It is interesting to note that, in their preface, the authors expressed thought that this book would soon be outdated. Ironically, their work became a standard reference and has remained the "Bible" in almost every large distillery operation.

low this range. By setting mashes freshly inoculated with yeast at low temperatures, yeast outgrows bacteria present because of the difference in optimal temperature. During plant breakdowns, grain cooked in batches may be held under slight pressure in the cookers. Holding at too high a temperature lowers the pH and increases proteolytic breakdown; holding without pressure is hazardous because the inner surfaces of vessels may not be in contact with mash and may have a low temperature. In spite of the fact that lactic acid bacteria grow fastest at 115° F., souring yeast mashes are held at 130° F.; that is, above the optimum temperature for lactic acid bacteria to prevent the reproduction of undesirable microorganisms.

Reduction of Water Content in Mashes.—Water is required for bacterial activity. To reduce the possibility of contamination, a mash of high sugar concentration i.e., a mash with a low content in water may be prepared for the cultivation of yeast. For the same reason, it is frequently advisable to use a low mashing ratio when cooking corn under atmospheric pressure; the reduction of the quantity of water prevents development of acid forming bacteria if it is necessary to hold unconverted starchy corn cooks for long periods of time. Mashes high in dextrines retard not only bacteria but also yeast.

pH Control.—In contrast to most bacteria, yeast not only withstands a high degree of acidity but also ferments most efficiently at a pH value of 4.0. A small degree of acidity suppresses the reproduction of bacteria without greatly interfering with their ability to produce acids or other products. To be effective, pH adjustment of mashes has to be immediate, because a lowering of the pH is of little value once bacteria have been allowed to multiply. If stillage is not used for pH adjustment, phosphoric acid or—more economically—sulfuric acid is added to the mash. Phosphoric acid is preferred because of its buffering capacity and value as yeast food. The addition of sulfuric acid to mashes occasionally gives rise to the formation of hydrogen sulfide. Commercial lactic acid is too expensive. Therefore, lactic acid bacteria are used to

sour yeast mashes. In order to avoid interference with the secondary amylase conversion, pH of a mash to be fermented is adjusted to a value sufficiently above 4.0, usually to 4.7-5.0.

Addition of Substances to the Mash for the Purpose of Inhibiting Bacterial Development.—Hops extract is occasionally used with water for preparation of yeast mashes because it contains resins and is believed to inhibit the growth of microorganisms. Yeast can be acclimatized to fluoride; ammonium bifluoride or sodium fluoride then may be added to grain mashes. To avoid any possible detrimental effect upon lactic acid bacteria, fluoride is added to yeast mashes at the end of the souring process. From the laboratory yeast culture to the main fermenting mash, the fluoride concentration is frequently decreased step by step in order to offset the retarding influence of this chemical upon fermentation. Lactic acid may have higher antiseptic properties than other acids. For this reason, lactic souring is preferred for pH adjustment of yeast mashes.

Effects of Bacterial Contamination.—At the usual fermentation temperature formation of acids, especially of acetic acid by bacteria may occur. The results of mash contamination are undesirable for the following reasons:

1. A low pH interferes with the secondary conversion by inactivating malt enzymes. If the pH falls to 4.0 or below, secondary conversion becomes negligible; this is quantitatively the most important factor leading to a lowering of yield in alcohol. During the fermentation process, malt converts approximately 20 to 30% or the original unfermentable material into maltose.
2. The type of acids produced, not the pH value as such, interferes with the activity of the yeast. Acetic acid is a specific poison, and in a concentration of 0.3% arrests fermentation.
3. Instead of being fermented into alcohol, some of the sugar (or alcohol) is diverted into acid. The following example